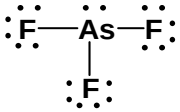
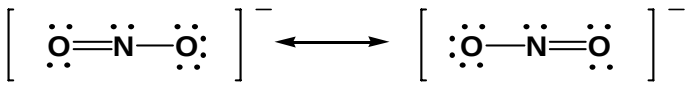
1. The three quantum numbers n=4, l=1, m_l=1 identify an electron in a hydrogen atom in what type of orbital?
2. Write the ground-state electron configuration of Sc.
3. Which of the following has the smallest atomic radius? (a) S (b) P (c) Si (d) Al (e) Cl
4. Match the following elements with their first ionization energies:Cl, Ge, K and 418, 1255, 784 kJ/mol.
5. Identify the ion with charge –3 and ground-state electron configuration [Ne]$3s^2 3p^6$.
6. Determine ΔE for each of these electron transitions. (a) n=7 to n=4 (b) n=4 to n=3 (c) n=3 to n=4
7. The laser light used in compact disc players has λ = 780 nm. In what region of the electromagnetic spectrum does this light appear? What is the energy of this light in kilojoules per mole?
8. The bond energy in NO is 632 kJ/mol.
   (a) What type of electromagnetic radiation (for example, infrared, UV, X-rays, etc.) would be required to break the NO bond in one NO molecule?
   (b) What type of electromagnetic radiation would be required to completely move an electron from the n=2 shell in a hydrogen-like atom to the n=5 shell?
9. (a) For green light of wavelength 520 nm, what is its frequency?
   (b) If an atom were to emit a photon whose wavelength was 520 nm, how much energy did the atom lose?
10. (a) How much energy is required to completely remove an electron from the ground state of hydrogen atom?
    (b) What wavelength of light would remove the electron?
11. (a) What is the hybridization around the P atom in PH_3?
    (b) What is the **molecular** geometry of PH_3?
    (c) What are the H–P–H bond angles?
12. Which of the following molecules have resonance structures? CO_2 NO SO_3 CO_3^{2-}
13. Determine the formal charges for each of the unique atoms in (a) SO_3^{2-} (no double bonds) (b) NH_4^+
14. What is the shape of the following molecules? Which are polar? (a) SO_2 (b) PH_3 (c) NO_3^- (d) CO_2
15. Draw a Lewis structure of carbon disulfide, CS_2 (central carbon atom). Assign formal charges to the atoms.
16. What shape do you expect for molecules that meet the following descriptions?
    (a) A central atom with no lone pairs and bonds to three other atoms.
    (b) A central atom with two lone pairs and bonds to two other atoms.
17. Draw the Lewis structure (and any resonance structures that exist) for each of the following and assign formal charges to the atoms. (a) AsF_3 (b) NO_2^- (nitrogen atom in center)
18. The number of orbitals in a given subshell, such as the 5d subshell, is determined by the number of possible values of
    (a) n (b) l (c) m_l (d) none of the these
19. Which of the following atoms would be more likely to form compounds that have more than eight valence electrons? C, H, B, S, F

Sample Exam - KEY

1. $4p$
2. $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^1\ 4s^2$ OR [Ne] $3s^2\ 3p^6\ 3d^1\ 4s^2$
3. (e) Cl
4. Cl = 1255 kJ/mol, Ge = 784 kJ/mol, K = 418 kJ/mol
5. P^{3-}
6. (a) -9.18×10^{-20} J (b) -1.06×10^{-19} J (c) 1.06×10^{-19} J
7. IR; 154 kJ/mol
8. (a) UV (b) visible
9. (a) $5.77 \times 10^{-14}\ s^{-1}$ (b) 3.82×10^{-19} J
10. (a) 2.18×10^{-18} J (b) 9.12×10^{-8} m
11. (a) sp^3 (b) trigonal pyramidal (c) approximately 109.5°
12. SO_3 & CO_3^{2-}
13. (a) S = +1, O = -1 (b) N = +1, H = 0
14. (a) bent, polar (b) trigonal pyramidal, polar (c) trigonal planar, nonpolar (d) linear, nonpolar
15. Just like CO_2 with S instead of O (see text p. 342). C = 0, S = 0
16. (a) trigonal planar (b) bent
17. (a) As = 0, F = 0 (b) N = 0, O (double bonded) = 0, O (single bonded) = -1





18. (c) m_l
19. S